

Zoology 250 Study Guide

A word to the wise: how to use this guide

It is not possible to summarize an entire course in a brief study guide. My goal here is to give you material you can use to 'quiz' yourself and jog your memory about important terms and concepts from material covered this semester. It does not cover absolutely everything and you shouldn't consider this a replacement for studying your notes, doing study questions, or text reading. Rather, consider it an aid to these approaches which I hope will be helpful.

Each topic is divided into two sections. The first lists important terms that we have covered. The second is a very brief listing of important concepts.

Note: For reasons known perhaps only to Bill Gates, I cannot seem to get rid of the last part of this (pages 13-14 following the section on hearing) which is just a section from the notes without crashing Word on my computer. Just ignore that section

Animal Size

Key Terms

Q₁₀ rule

Endotherm

Ectotherm

specific metabolic rate

Key Concepts

Diffusion and major factors affecting this (DAnG)

Metabolic Rate and major factors affecting this

- body size effects (the 'mouse to elephant' curves)
- temperature effects
- endotherm/ectotherm differences

Feeding and Digestion

Key Terms

heterotrophs

Ingestion

Digestion

Absorption

Elimination

polymers/monomers

Digestive Tracts

Oral cavity and pharynx

peristalsis

epiglottis

Crops and Gizzards

rumen

zymogen (various specific proteins)

duodenum

amylase

lipase

small and large intestine

Pharynx and Esophagus

bile and emulsification

hepatic portal vein

Key Processes and Concepts

- Converting bulky food items into a form which can be absorbed
- The initiation of digestion for different nutrient types in different locations
- Protection of the stomach from self digestion
- specializations of the small intestine for absorption (4)
- small intestine adaptations to diet
- why is emulsification necessary?

Support and Movement

Key Terms

Hydrostatic skeletons, Exoskeleton, Endoskeleton

Myosin

Tendons

Actin

Ligaments

Troponin and Tropomyosin

Axial skeleton

Sarcoplasmic Reticulum (SR)

Appendicular skeleton

transverse tubules

hydroxyapatite

neuromuscular junction

ossification

acetylcholine

lacunae

tetanus

canaliculi

motor units

Haversian systems

creatine phosphate

Key Processes and Concepts

- Limitations to exoskeletons
- graded contractions and summation
- motor unit recruitment
- role of ATP in muscle contraction
- muscle adaptations for power vs. endurance (muscle types and exercise effects)
- muscle characteristics (smooth, skeletal, cardiac – size, control, morphology)
- Bone functions

Circulatory Systems

Key Terms

hemocoel	Bundle of His
atria and ventricles	elastin
semilunar and atrioventricular valves	endothelium
sinoatrial node, atrioventricular node	Rete
intercalated disks	Red and White blood cells
ductus arteriosus, foramen ovale	platelets and clotting

Key Processes and Concepts

- Single vs. double circulations (ancestral vs. derived in vertebrates)
- Characteristics of open vs. closed systems: phylogenetic distribution and functional characteristics
- Electrical coupling of cardiac muscle cells and role of AV node
- Adaptations to increase exchange by diffusion
- Need for and function of lymphatic system
- Blood cell formation
- Clotting cascade

Gas Exchange

Key Terms

alveoli

diaphragm muscle

air sacs

parabronchial lung

Tracheal systems/Tracheoles

spiracles

Hemoglobin/heme group

Hemocyanin

Key Processes and Concepts

- Different characteristics of Oxygen and CO₂
- Types of respiration
- Countercurrent exchangers
- negative vs. positive pressure ventilation
- mammalian adaptations for ventilation
- Respiratory pigments – why have these?
- Cooperative binding in hemoglobin - pH effects (Bohr effect), fetal adaptations
- CO₂ vs. O₂ transport in blood
- heat and water loss during respiration

Immunity

Key Terms

inflammation

T-cells (helper and cytotoxic)

B-cells

chemokine

lysozyme

Neutrophils

Monocytes

Macrophages

Natural killer cells

CD4

CCR5

perforin

Key Processes and Concepts

- non-specific defenses: competition, etc.
- Fever as a defense (and other similar defensive strategies)
- Key Features of the immune system
- Origins of T and B cells
- Clonal selection and antibody diversity
- antibody structure and actions
- cell vs. antibody mediated immunity
- Memory in the immune system
- Self vs. non-self recognition
- Allergies and the IgE system
- Mechanisms of HIV action and AIDS – why is it so tough to fight?

Regulation of the Internal Environment

Key Terms

Homeostasis

Osmoconformer

Osmoregulator

Ammonia, Urea, Uric acid

malpighian tubules

nephridia

kidneys: cortex and medulla

nephron

Glomerulus

Loop of Henle

Collecting duct

ultrafiltrate

ectotherm

endotherm

Torpor/Hibernation

Key Processes and Concepts

- Osmoregulation and Ionoregulation in seawater vs. freshwater
- Chondrichthyan (e.g., sharks) solutions to seawater life
- Types of nitrogenous wastes – which animals and habitats is each found in?
- Kidney function: indiscriminate filtration followed by selective reabsorption
- Countercurrent multiplier function of Loop of Henle
- Temperature regulation mechanisms
- Evaporative cooling and water loss
- Adaptations to heat and cold (freeze tolerance, hibernation, cooling blood in hot climates, anhydrobiosis)

Hormones and the Endocrine System

Key Terms

hormone	hypothalamus
pheromone	pituitary: anterior and posterior
neurosecretory cell	thyroid
target cells	adrenal
receptors	LHRH/GnRH
second messengers: cAMP, IP ₃	oxytocin
Adenylyl cyclase	vasopressin
Phospholipase C	tropic hormones
G proteins	portal system

Luteinizing hormone (LH)

Follicle stimulating hormone (FSH)

Thyroid stimulating hormone releasing hormone (TRH)

Thyroid stimulating hormone (TSH)

Thyroid hormone

androgens, estrogens, progestins

Key Processes and Concepts

- Why an endocrine system?
- Characteristics of hormone actions
- Signal amplification by second messengers
- Differences between the anterior and posterior pituitary
- Negative feedback in the endocrine system

Sex Determination and Differentiation

Key Terms

heterogametic vs. homogametic sex

SRY

genotypic sex determination

environmental sex determination (e.g., social, temperature)

parthenogenesis

endocrine disruptors

environmental estrogens

bioaccumulation

Key Processes and Concepts

- Distinguish sex determination from sexual differentiation
- Types of sex determination
- Basic female pattern of sexual development in mammals in absence of other influences

Nervous Systems

Key Terms

Neuron	Axon
Dendrite	Soma (cell body)
synapse, synaptic cleft, synaptic vesicles	
Glial cells (Schwann cells, Oligodendrocytes, astrocytes)	
myelin and myelination	saltatory conduction
Ion channels – gated and non-gated	Central vs. peripheral nervous system
EPSPs and IPSPs	peripheral sensory vs. motor
refractory period	
peripheral somatic vs. autonomic (sympathetic vs. parasympathetic)	
cephalization	Myelencephalon
cerebrospinal fluid	Medulla oblongata
Telencephalon	Cerebellum
Diencephalon	Hypothalamus
Mesencephalon	Cerebral Cortex
Metencephalon	

Key Processes and Concepts

- Why a nervous system?
- Three phases of nervous processing: sensory input, integration, motor output
- Characteristics of neurons
- Glial cell necessity and function
- The membrane potential: how it is generated, what role specific proteins play, the critical importance of passive diffusion by K^+
- Depolarization and Hyperpolarization effects on neurons
- Action potentials: what is happening with specific proteins at each step and what role they play
- Travel of the action potential (why in only one direction?)
- Limits on conduction speed and adaptations to increase this
- Demonstrations of neurotransmitter function: what do you need to show?
- Parasympathetic vs. sympathetic autonomic effects

Sensory Systems

Key Terms

General senses: Mechanoreception, Thermoreception, Nociception

Special senses: Chemoreception: taste/smell; Photoreception: Vision; Mechanoreception:

vibration/hearing

Muscle spindle

proprioception

Somatotopic map

Pacinian corpuscle

Key Processes and Concepts

- Receptor potential
- Intensity coding
- Adaptation
- Tactile discrimination

Vision

Key Terms

ommatidium

Vertebrate eye: Cornea, lens, retina, sclera, ciliary muscles, fovea, rods, cones

Opsins and retinal

Rhodopsin

Pigments and color vision

Key Processes and Concepts

- Creating an image like a computer (insects, crustaceans) vs. like a camera (vertebrates)
- The retina as an extension of the brain and first site of processing
- The blind spot and 'wiring' of neurons to the retina
- Refraction and the process of accommodation
- Photoreceptor activation: rhodopsin and Na⁺ channels
- Visual cortex as primary site of integration

Hearing and Balance

Key Terms

statocysts

statoliths

tympanum

neuromast organ

basilar and tectorial membranes

hair cell

cochlea

oval window

Key Processes and Concepts

- Amplification by the middle and external ears
- Sensory transduction by the inner ear/cochlea
- Frequency discrimination by the cochlea
- Directional information by differences in intensity and time of arrival

Olfaction and Taste

Key Terms

chemoreception

sensilla

main olfactory system

vomer nasal system

olfactory epithelium

olfactory bulb

accessory olfactory bulb

pheromones

glomeruli (glomerulus is singular)

Key Processes and Concepts

- insect chemoreception as shown by Bombykol example
- olfactory neurons as site of olfactory sensory transduction
- olfactory receptors and g-protein coupled receptors
- specificity of olfactory receptors (1 type per neuron)
- different pathways into CNS for main olfactory vs. vomeronasal systems

Brain and Emotion

Key Terms

Limbic system

Amygdala

Hypothalamus

serotonin

dopamine

reuptake inhibitors

Key Processes and Concepts

- Hypothalamus as integrative center and link between the CNS and the endocrine system
- Serotonin links to aggression, depression and sexual behavior
- Effects of altering neurotransmitter metabolism through blockage of breakdown or reuptake and long term effects of these changes
- Anterior hypothalamus and male-typical sexual behavior
- Neural sex differences (e.g., corpus callosum, anterior commissure, INAH3, suprachiasmatic nucleus)

somatic: innervates skeletal muscle

autonomic: innervates and regulates the internal environment

Autonomic nervous system: 2 divisions

- This system exerts control over involuntary functions
 - usually opposing input from the two divisions
- Parasympathetic Division
 - Neurotransmitter: Acetylcholine

Sympathetic division

- Associated with 'alert' state functions
- Neurotransmitter used: Norepinephrine

Central Nervous System

- Consists of brain and spinal cord
 - extreme cephalization in case of brain

 - basically a specialized tube in vertebrates

 - Function: Integration of information - interneurons located here
- Wrapped in protective layers known as meninges
 - a Bathed in cerebrospinal fluid
 - a outer layer: dura mater
 - a middle layer: arachnoid mater
 - a inner layer: pia mater

The Vertebrate Brain

- Ancestral organization: 3 functional regions
 - olfactory
 - visual
 - balance/vibration
- Five main parts in living vertebrates:
 - Telencephalon
 - Diencephalon

- Mesencephalon
- Metencephalon
- Myelencephalon